

A newly recorded genus *Microdynerus* Thomson, 1874 and a review of its related genus *Leptochilus* de Saussure, 1853 (Hymenoptera, Vespidae, Eumeninae) from China

Yue Bai¹, Bin Chen¹, Ting-Jing Li¹

¹ Chongqing Key Laboratory of Vector Insects, Institute of Entomology and Molecular Biology, College of Life Science, Chongqing Normal University, Chongqing 401331, China

Corresponding author: Ting-Jing Li (ltjing1979@hotmail.com)

Academic editor: Michael Ohl | Received 3 September 2023 | Accepted 29 January 2024 | Published 9 February 2024

<https://zoobank.org/727CB19F-EC87-4F6F-AEA5-1B696C959040>

Citation: Bai Y, Chen B, Li T-J (2024) A newly recorded genus *Microdynerus* Thomson, 1874 and a review of its related genus *Leptochilus* de Saussure, 1853 (Hymenoptera, Vespidae, Eumeninae) from China. Journal of Hymenoptera Research 97: 57–83. <https://doi.org/10.3897/jhr.97.112108>

Abstract

In this paper, the genus *Microdynerus* Thomson 1874 is newly recorded from China with one species *Microdynerus* (*Pseudomicrodynerus*) *parvulus* (Herrich-Schäffer, 1838). Furthermore, a total of ten species of the genus *Leptochilus* de Saussure is recorded from China, including one new species, i.e., *Leptochilus* (*Lionotulus*) *angulus* **sp. nov.**, which is described and illustrated in detail. Of the remaining nine *Leptochilus* species three are recorded here for the first time from China, i.e., *L. (Lionotulus) argentifrons* (Kostylev, 1935), *L. (Lionotulus) callidus* (Kostylev, 1940), and *L. (Lionotulus) locuples* Giordani Soika, 1970, whereas the remaining six species, i.e., *L. (Lionotulus) chinensis* Gusenleitner, 2001, *L. (Lionotulus) gobicus* (Kostylev, 1940), *L. (Lionotulus) habyrchanus* Kurzenko, 1977, *L. (Lionotulus) incertus* (Kostylev, 1940), *L. (Lionotulus) kozlovi* Kurzenko, 1977, and *L. (Neoleptochilus) tibetanus* Giordani Soika, 1966, have been documented from China before. All treated species are diagnosed and illustrated. Finally, a key to the Chinese species of the two related genera is provided.

Keywords

China, Eumeninae, Hymenoptera, *Leptochilus*, *Microdynerus*, new record, new species

Introduction

The genus *Microdynerus* Thomson, 1874 in the subfamily Eumeninae contains three subgenera with 53 valid species and six subspecies (Carpenter, unpublished). The nominotypical subgenus *Microdynerus* (*Microdynerus*) is distributed mainly in the Palearctic Region with the exception of a few species occurring in Nearctic Region. The distribution of the other two subgenera *M.* (*Pseudomicrodynerus*) and *M.* (*Alastorynerus*), both of them currently comprising only four species each, is limited to Palearctic Region. Both were first described as genera by Blüthgen (1938) and then downgraded to the subgeneric level by Carpenter (1986) and Gusenleitner (1997) respectively. Species of the genus are usually small (4.5–7.5 mm) and show often a medially transverse raised bulge on the metanotum, which gives them a superficially similar appearance to the genus *Leptochilus* de Saussure 1853. In fact, some species of these two genera were confused before (Arens 2001). To date, there was no record of *Microdynerus* in China, whereas, the *Leptochilus* was known from China by six species. In our collections of Chinese eumenids, two specimens of the genus *Microdynerus* were initially misidentified and mixed with those of *Leptochilus*.

Leptochilus is a larger group distributed in most of global zoogeographic regions (except Australian Region), containing six subgenera with 198 species: *L.* (*Euleptochilus*) Blüthgen, *L.* (*Leptochilus*) de Saussure, *L.* (*Lionotulus*) Blüthgen, *L.* (*Neoleptochilus*) Blüthgen, *L.* (*Sarochilus*) Gusenleitner, and *L.* (*Zendalia*) Robertson. Among the known species, more than 130 species belonging to the first five subgenera above occur in the Palearctic Region (Fateryga 2018; Fateryga and Fateryga 2021). The distribution of the remaining subgenus *L.* (*Zendalia*) Robertson 1928, however, is restricted to the Nearctic and Neotropical regions. The taxonomic development of the genus *Leptochilus* was shaped by Blüthgen (1938–1967), Parker (1966), Giordani Soika (1938–1986), Gusenleitner (1966–2017), and others. Since the 1970s, a large number of species in this genus had been described by Gusenleitner (1973, 1976, 1977, 1979, 1995, 2001, 2002, 2006) and Giordani Soika (1970, 1976, 1979, 1986). In China, five species of the subgenus *L.* (*Lionotulus*) and one of the subgenus *L.* (*Neoleptochilus*) were sporadically recorded (Kostylev 1940; Giordani Soika 1966; Kurzenko 1977; Gusenleitner 2001).

In the present paper, the genus *Microdynerus* with the species *M.* (*Pseudomicrodynerus*) *parvulus* (Herrich-Schäffer, 1838) was newly recorded and illustrated in China. Furthermore, all known species of the genus *Leptochilus* in China are systematically revised and ten species belonging to the two subgenera *L.* (*Lionotulus*) and *L.* (*Neoleptochilus*) are recognized from Xinjiang, Xizang, Qinghai, Gansu, and Inner Mongolia of China. Based on the pertinent literature and available specimens, one of these species in *Leptochilus* are identified as new to science and three are new records. The new species is described and illustrated in detail, and nine other species of *Leptochilus* are provided with diagnosis and figures. A key to the Chinese species of the two genera *Microdynerus* and *Leptochilus* is given. Finally, a distribution map (Fig. 95) of all known species of these two genera *Leptochilus* and *Microdynerus* in China is provided.

Materials and methods

The specimens examined in our study are deposited in the Institute of Entomology and Molecular Biology, Chongqing Normal University, Chongqing, China (CNU), and Zoological Institute in St. Petersburg, Russia. Descriptions and measurements were made under a stereomicroscope (Olympus SZ61).

Once a male specimen was available, we softened the specimen and directly dissected the genitalia with a dissecting needle for comparison, and then stored it in anhydrous alcohol for subsequent review. Male genitalia were extracted from softened specimens and directly dissected with a dissecting needle for comparison, and then stored it in anhydrous alcohol for subsequent review.

All photos and measurements were taken with Keyence VHX-5000 digital microscope and Photoshop CS 6 was used to compile the photo plates. Body length was measured from the anterior margin of the head to the posterior margin of metasomal tergum 2. If the pinned specimens were not horizontally oriented, a segmented approach was adopted to measurement. For the density description of punctures, “sparsely” means that interspaces are larger than one puncture diameter, “moderately” means equal to the diameter, and “densely” means less than one diameter. The abbreviations used in the text are shown as follows: A (1, 2, ...) for antennal joints, T (1, 2, ...) for metasomal terga, S (1, 2, ...) for metasomal sterna.

Descriptions and keys are based on available specimens and the most pertinent literature, among which keys in Gusenleitner (1993) and Selis (2023) and descriptions in Giordani Soika (1966), Kurzenko (1977) and Gusenleitner (2021) have been applied mainly. The species discussed are alphabetically listed in the text. The used terminology principally follows Carpenter (1981 (1982)).

Results

Genus *Leptochilus* de Saussure, 1853

Leptochilus de Saussure, 1853: 233; Giordani Soika 1938: 2–14; 1941: 7–13; Parker 1966: 151–229; van der Vecht and Fischer 1972: 42–53.

Type species. *Pterochilus mauritianus* [!] [= *Pterochilus mauritanicus* Lepeletier, 1841], by subsequent designation of Ashmead 1902.

Diagnosis. Body length < 9.0 mm; without epicnemial carina; axillary fossa of scutellum oval, broader than long; metanotum with horizontal carina between dorsally and posterior surfaces; propodeum with submarginal carina projecting as rounded lobe above valvula and bilamellate; T1 depressed subapically, gradually widened with lateral sides divergent in dorsal view; T2 with flat or concave apical lamella.

Distribution. Worldwide except Australian region.

***Leptochilus (Lionotulus) angulus* Bai, Chen & Li, sp. nov.**

<https://zoobank.org/501C27FC-7DE5-4667-BA21-EF1A0A4EC4CC>

Figs 1–9

Material examined. *Holotype*, ♀, CHINA, Inner Mongolia, Urad Front Banner, Xin'an Town, Shulin Village, 40.945°N, 108.633°E, 989 m, 3.VIII.2016, Zhenxia Ma (CNU); *paratypes*, 3♀, same data as holotype.

Diagnosis. This species resembles *L. (L.) callidus* (Kostylev, 1940) with similar clypeus punctures (Figs 2, 3, 19) and occipital carina (Figs 4, 24). It can be distinguished from the related species and other members of the genus by the following character combination: pronotal carina transparent and obvious (Fig. 5), propodeum with long and undeveloped carina between dorsal and posterior surfaces, posterior surface with oblique and long striae, propodeal carina as long as propodeal concavity (Fig. 7).

Description. Female. Body length 5.5–6.3 mm (Fig. 1), forewing length 5.4–6.2 mm; black, with the following parts light yellow: basal spot of clypeus (or not), an anterior interrupted band of pronotum dorsally, most of tegula except the median transparent part, apical margin of scutellum, small dorsal spots of mesopleuron (or not), apical margin of femora, tibiae (slightly dark at apical margin) and tarsi, apical bands of T1–T2 (T1 subterminal part ferruginous or not), apical small spots on both sides of S2, and apical spots of T3–T5 in the middle (or not).

Head. In front view, clypeus wider than long (1.4×), and apically with emargination wider than depth (2.2×–2.5×) (Figs 2, 3), clypeus laterally with dense short white setae; clypeus with small and dense punctures basally, and with bigger and coarser punctures on apical half; frons, vertex and gena with coarse and dense punctures; occipital carina forming obvious angle latero-ventrally (Fig. 4).

Mesosoma. Mesosoma with irregular coarse punctures, interspaces between punctures with minute punctures; mesoscutum on anterior half and mesopleuron ventrally with sparse punctures (Figs 1, 6); pronotal carina transparent and obvious (Fig. 5); metapleuron and lateral surfaces of propodeum with unbroken finely horizontal striae, and lateral surface of propodeum densely striate mixed with irregular punctures (Fig. 6); propodeum with long and undeveloped carina between dorsal and posterior surfaces (Fig. 7); posterior surface with oblique and long striae, propodeal carina present in lower part and half as long as propodeal concavity (Fig. 7).

Metasoma. Metasoma leathery, with smaller and sparser punctures than those on head and mesosoma (Figs 8, 9); punctures of T1 larger than the second metasomal segment, punctures of metasomal segments 2–3 larger than those on metasomal segments 4–6; in dorsal view, the first metasomal segment semi-circular (Fig. 1); the second one with wide apical lamellae and with a row of great punctures at base of lamellae, interspaces between punctures short carina-formed; S2 weak convex in lateral view (Fig. 8), with shallow and long longitudinal medial furrows at base (Fig. 9).

Male. Unknown.

Distribution. China (Inner Mongolia).

Etymology. The specific name *angulus* is derived from Latin word: *angulus*, referring to occipital carina forming obvious angle latero-ventrally.



Figures 1–9. *Leptochilus (Lionotulus) angulus* sp. nov., holotype (♀) **1** habitus in dorsal view **2, 3** head in frontal view **4** gena in lateral view **5** vertex and pronotum **6** mesosoma in lateral view **7** propodeum in posterior view **8, 9** metasoma in lateral view.

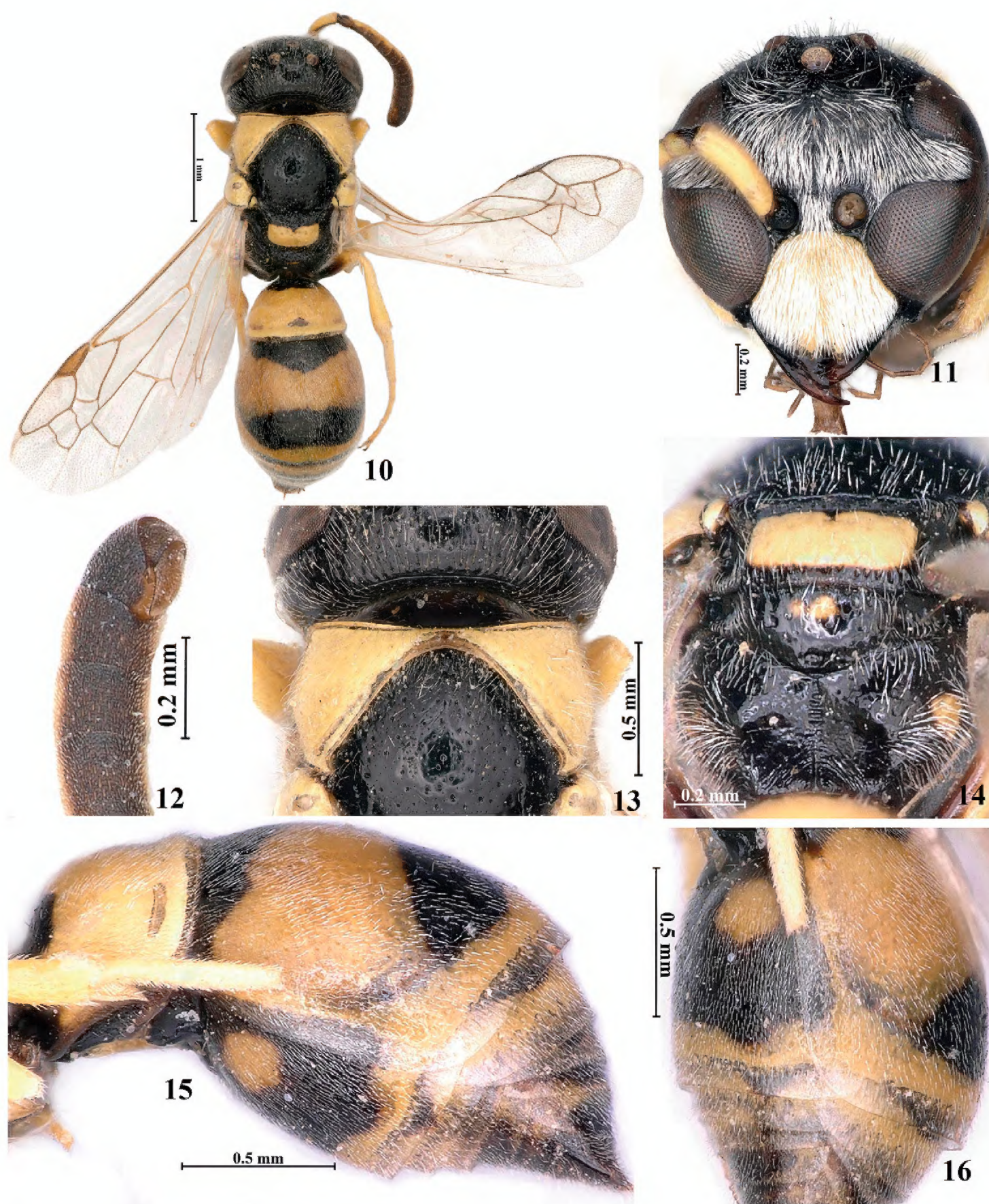
***Leptochilus (Lionotulus) argentifrons* (Kostylev, 1935)**

Figs 10–16

Microdynerus argentifrons Kostylev, 1934: 137; Kostylev 1940: 37; van der Vecht and Fischer 1972: 45.

Material examined. 1♂, CHINA, Xinjiang, Bayinguoleng Mongolian Autonomous Prefecture, Ruoqiang County, 14.V.2010, Zhaohui Luo (CNU).

Diagnosis. Female body length 5.0 mm; male body length 4.5 mm, forewing 4.3 mm (Fig. 10); body with small and sparse punctures, interspaces between punctures



Figures 10–16. *Leptochilus (Lionotulus) argentifrons* (Kostylev, 1935) ♂ **10** habitus in dorsal view **11** head in frontal view **12** part of antenna **13** vertex and pronotum **14** propodeum in posterior view **15, 16** metasoma in lateral view.

polished (Fig. 10); with obvious white setae; black, with the following parts yellow: clypeus, scape, flagellum except dorsally, pronotum, tegula, parategula, scutellum at posterior half, posterodorsal spot of mesopleuron, legs (except basal margins of femora), mostly on apical margin of T1, wide band in the part middle area of T2, lateral

spot of S2, apical bands of metasomal segments 2–5. In front view, frons with dense setae (Fig. 11); clypeus wider than long, apically with deep emargination in male, and emargination wider than depth (1.8×); A13 sharp at the apex (Fig. 12); ocelli large; occipital carina curved latero-ventrally. Pronotal carina obvious (Fig. 13); propodeum smooth (Fig. 14), with boundary between dorsal and posterior surfaces, but without carina; propodeal carina present in lower half, and less than 1/2 of propodeal concavity. Metasomal segments 2–4 with wide apical lamellae and the second metasomal segment with a row of great punctures at base, interspaces between punctures short carina-formed (Fig. 15); S2 weak convex in lateral view, with shallow and short longitudinal medial furrows at base (Fig. 16).

Distribution. China (new record: Xinjiang), Turkmenistan.

***Leptochilus (Lionotulus) callidus* (Kostylev, 1940)**

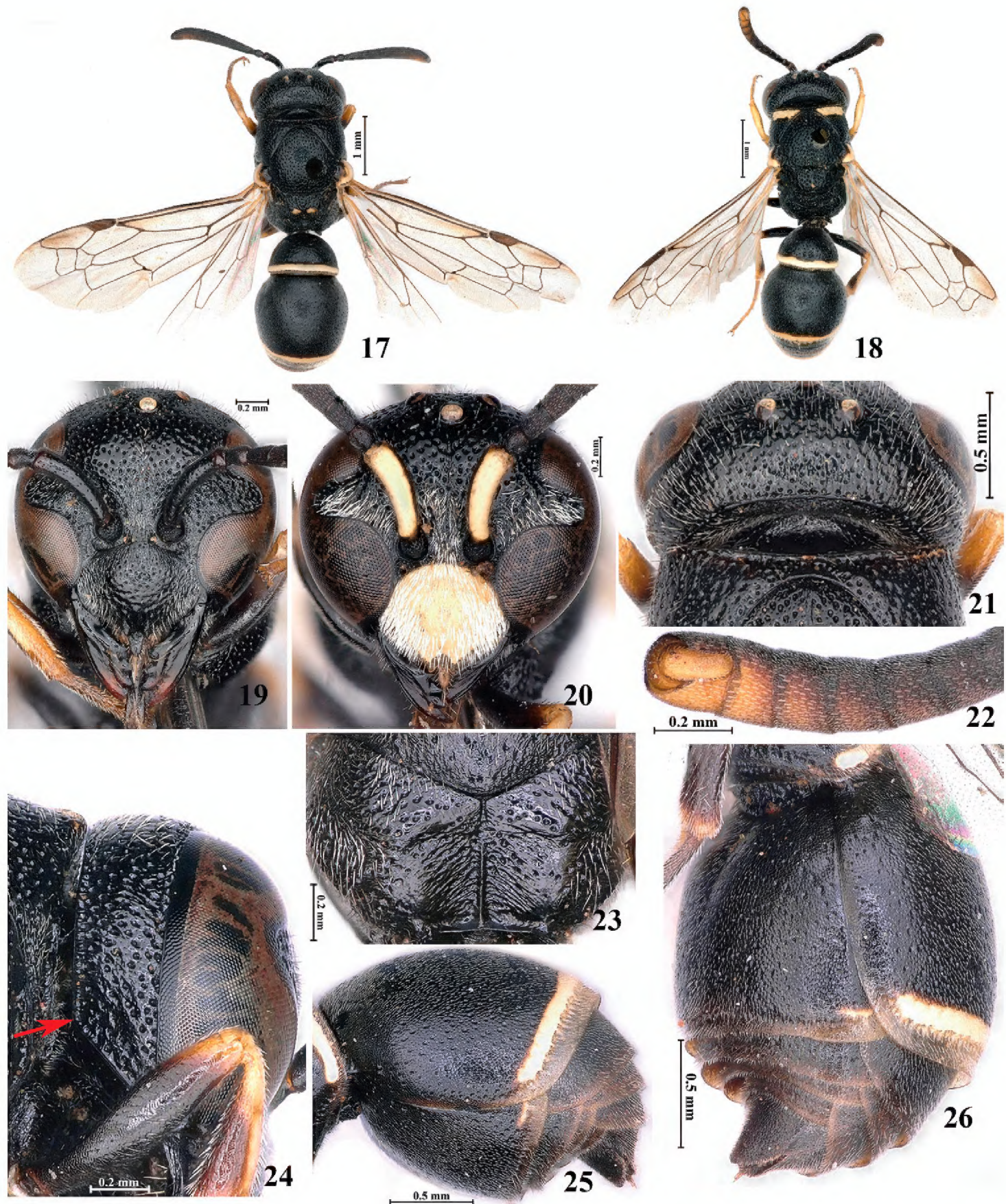
Figs 17–26

Odynerus callidus Kostylev, 1940: 33.

Leptochilus callidus: van der Vecht and Fischer 1972: 46.

Material examined. 1♀, 1♂, CHINA, Inner Mongolia, Ewenki Autonomous Banner, Yimin Town, Five Pastureland, 8.VIII.2006, Tingjing Li (CNU); 2♂♂, CHINA, Ningxia, Yinchuan City, Helan County, Jinshan Township, Lujiawazi, 38.694°N, 106.174°E, 1117 m, 21.VII.2020, Yujiang Yao, Rongyuan Zhang (CNU); 1♂, CHINA, Ningxia, Wuzhong City, Yanchi County, Huamachi Town, Yikeshu Village, 37.891°N, 107.434°E, 1312 m, 25.VII.2020, Qianchen Wang, Rongyuan Zhang (CNU).

Diagnosis. Female body length 6.1 mm, forewing 5.7 mm (Fig. 17); male body length 4.9–5.5 mm, forewing 4.4–5.0 mm (Fig. 18); black, with the following parts light yellow: clypeus of male, scape ventrally in male, an anterior interrupted band of pronotum dorsally in male, outer margin of tegula, two spots on posterior margin of scutellum in female, apical margin of femora, tibiae (slightly dark ventrally) and tarsi, apical bands of T1–T2, apical small spots of S2 laterally; A8–A12 ventrally deep yellow. In front view, clypeus wider than long (1.3× in female, 1.1× in male), and apically with shallow emargination wider than depth (2.9× in female, 2.7× in male) (Figs 19, 20); clypeus in female with sparse and coarse punctures, interspaces between punctures with transverse wrinkles on apical half (Fig. 19), clypeus in male with sparse and small punctures (Fig. 20); clypeus and frons at lower part in male with dense white setae (Fig. 20); A13 almost parallel on both sides at the apex (Fig. 22); frons, vertex and gena with coarse and irregular punctures; frons punctures in male larger than those in female; occipital carina forming obvious angle latero-ventrally (Fig. 24). Mesosoma with irregular and coarse punctures, interspaces between punctures with minute punctures; posterior margin of mesoscutum and mesopleuron dorsally with dense punctures, interspaces between punctures reticulate; pronotal carina non-transparent and obvious (Fig. 21); metapleuron dorsally with coarse horizontal striae, ventrally leathery and



Figures 17–26. *Leptochilus (Lionotulus) callidus* (Kostylev, 1940) ♀ 17, 19, 21, 23–26 ♂ 18, 20, 22. 17, 18 habitus in dorsal view 19, 20 head in frontal view 21 vertex and pronotum 22 part of antenna 23 propodeum in posterior view 24 gena in lateral view 25, 26 metasoma in lateral view.

with irregular fine striae; propodeum dorsally with coarse and dense punctures; carina degenerate between dorsal and posterior surfaces (Fig. 23); posterior surface with long and oblique striae mixed with coarse punctures, propodeal carina present in lower part and about 2/3 of propodeal concavity (Fig. 23). Metasoma leathery, with small and

sparse punctures; the second metasomal segment with wide apical lamellae and there with a row of great punctures at base, interspaces between punctures short carina-formed (Fig. 25); S2 weak convex in lateral view (Fig. 25), with shallow longitudinal medial furrows at base, and half as long as S2 (Fig. 26).

Distribution. China (new record: Inner Mongolia, Ningxia), Central Asia from Lake Aral to Gobi Desert.

***Leptochilus (Lionotulus) chinensis* Gusenleitner, 2001**

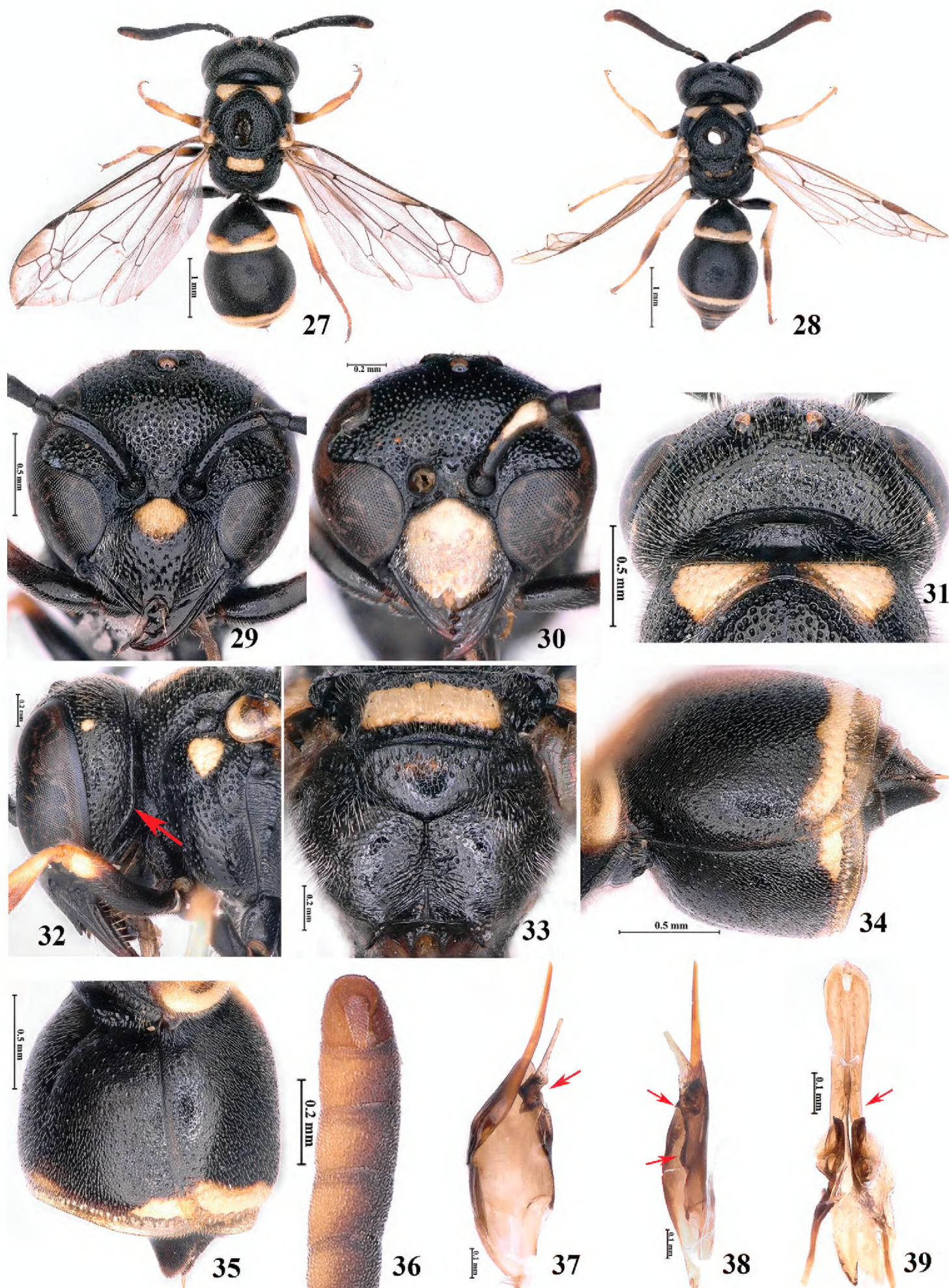
Figs 27–39

Leptochilus chinensis Gusenleitner, 2001: 239.

Material examined. 1♀, CHINA, Inner Mongolia, Hohhot, Horinger County, Suojiayao Village, 40.570°N, 111.966°E, 1230 m, 25.VII.2019, Xue Zhang (CNU); 2♂♂, CHINA, Inner Mongolia, Hohhot, Wuchuan County, Daqingshan Town, Sanchakou Village, 41.003°N, 111.533°E, 1661 m, 23.VII.2019, Pan Huang (CNU); 2♂♂, CHINA, Inner Mongolia, Hohhot, Wuchuan County, Daqingshan Town, Dongyaozi, 40.930°N, 111.393°E, 1503 m, 24.VII.2019, Xue Zhang (CNU); 1♂, CHINA, Inner Mongolia, Tongliao city, Daqinggou, 11.VIII.2006, Ming Luo (CNU).

Diagnosis. Female body length 5.5 mm (Fig. 27); male body length 4.5–4.8 mm, forewing 4.3–4.5 mm (Fig. 28); black, with the following parts yellow: clypeus basal marking in female, complete clypeus in male, scape ventrally in male, small spot of gena, two anterior marking of pronotum dorsally, spot of mesopleuron dorsally, tegula, posterior margin of scutellum, apical margin of femora, tibiae and tarsi, narrow apical bands of T1–T2 (broader of T1 laterally), broken apical bands of S2. In front view, clypeus wider than long (1.4× in female, 1.1× in male), and apically emargination wider than depth (2.3× in female, 1.8× in male) (Figs 29, 30); clypeus in female with sparse and coarse punctures on basal half, with dense and larger punctures on apical half (Fig. 29); clypeus in male with sparse and small punctures, with dense white setae (Fig. 30); frons, vertex and gena with coarse and dense punctures, occipital carina curved latero-ventrally (Fig. 32); A13 sharp at the apex (Fig. 36). Mesosoma with coarse and dense punctures; pronotal carina degenerate (Fig. 31); metapleuron and lateral surfaces of propodeum with unbroken finely horizontal striae; propodeum posterior surfaces with wide propodeal concavity, with long and oblique striae laterally, propodeal carina present in lower part, and short about 1/3 as long as the propodeal concavity (Fig. 33); hind tarsus in male swollen (Fig. 28). Metasoma leathery, with sparse and small punctures (Figs 27, 28); the second metasomal segment with wide apical lamellae and there with a row of great punctures at base, interspaces between punctures short carina-formed (Fig. 34); S2 strong convex in lateral view (Fig. 34), with deep longitudinal medial furrows at base (Fig. 35); volsella with lateral processes in the middle and basal parts (Figs 37, 38), penis valve slightly narrow in the middle part, with depression at the top (Fig. 39).

Distribution. China (Inner Mongolia, Shaanxi, Ningxia).



Figures 27–39. *Leptochilus (Lionotulus) chinensis* Gusenleitner, 2001 ♀ 27, 29, 31–35 ♂ 28, 30, 36–39. 27, 28 habitus in dorsal view 29, 30 head in frontal view 31 vertex and pronotum 32 gena in lateral view 33 propodeum in posterior view 34, 35 metasoma in lateral view 36 part of antenna 37, 38 volsella 39 penis valve.

***Leptochilus (Lionotulus) gobicus* (Kostylev, 1940)**

Figs 40–45

Odynerus gobicus Kostylev, 1940: 36.*Leptochilus gobicus*; van der Vecht and Fischer 1972: 47.

Material examined. *Holotype*, ♂, Tzoto, Alachan, Gobi, 9.V.1908, P. Kozlov! (Zoological Institute in St. Petersburg); *paratype*, 1♀, same data as holotype.

Diagnosis. Female body length 5.5 mm (Fig. 40); black, with the following parts yellow: small spot of gena, A6–A13 of male, two anterior small spots of pronotum dorsally, outer margin of tegula, posterior margin scutellum in male, apical margin of femora, part of tibiae and tarsi (hind tarsus dorsally brown), narrow apical bands of T1–T2, apical spots of S2 laterally. Body with sparse white setae, and with minute and sparse punctures (Figs 40, 41); clypeus wider than long (1.3× in female, 1.1× in male), and apically emargination wider than depth (3.0× in female, 1.9× in male) (Figs 42, 43); clypeus in female with sparse and shallow punctures, base of emargination without punctures and smooth (Fig. 42); clypeus in male with dense setae (Fig. 43); frons, vertex and gena with coarse and sparse punctures. Punctures of mesosoma coarser and denser than those on head and metasoma; pronotal carina unobvious (Figs 40, 41); A13 sharp at the apex (Fig. 45); the first hind tarsus in male swollen (Fig. 44). Metasoma leathery, with sparse and small punctures; the second metasomal segment with wide apical lamellae and there with a row of great punctures at base, interspaces between punctures short carina-formed (Fig. 44); S2 weakly convex in lateral view (Fig. 44).

Distribution. China (Inner Mongolia).

***Leptochilus (Lionotulus) habyrghanus* Kurzenko, 1977**

Figs 46–57

Leptochilus habyrghanus Kurzenko, 1977: 550.

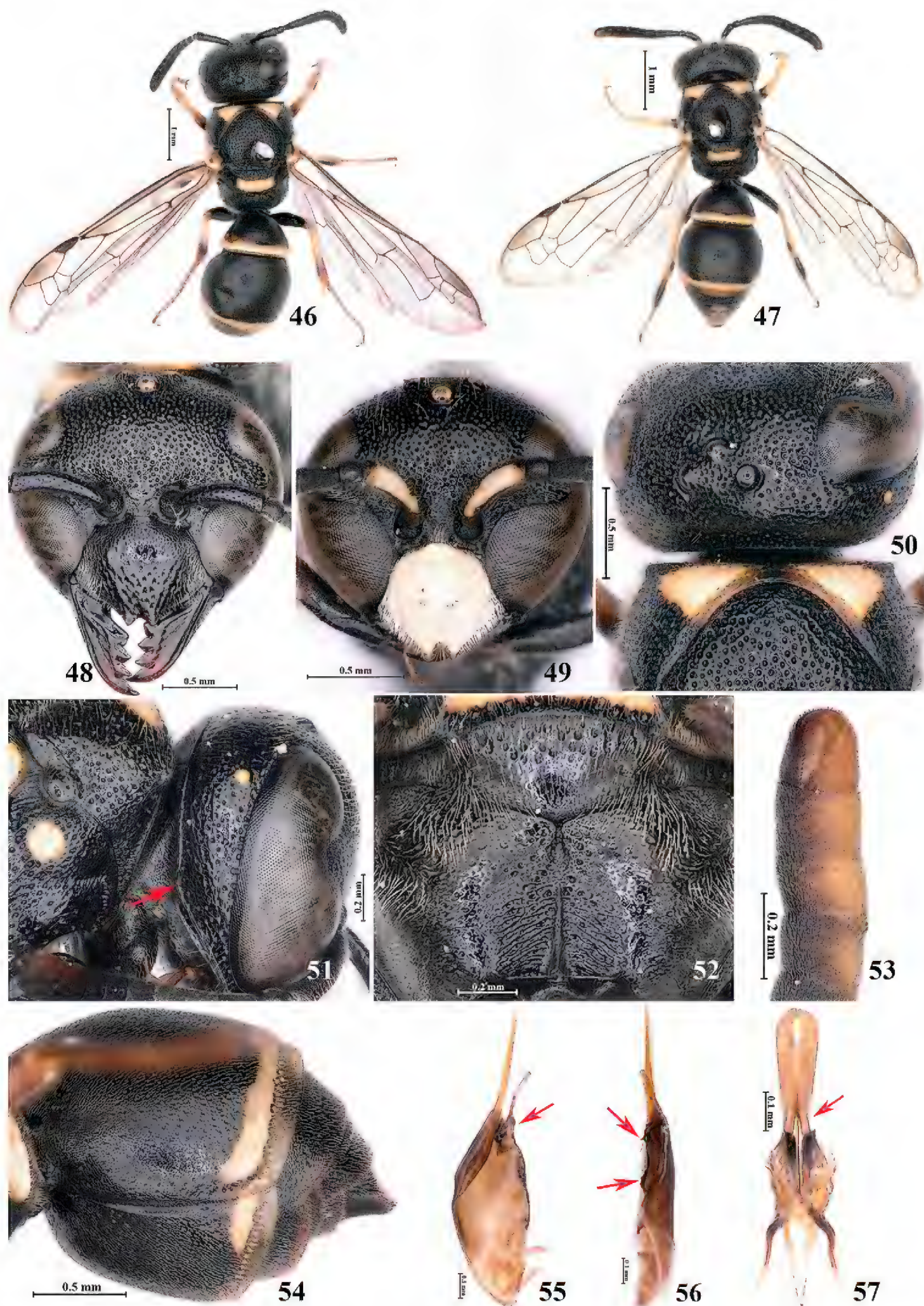
Material examined. 2♀♀, CHINA, Gansu Province, Weiwu City, Qilian Town, Qilian Township, 37.678°N, 102.422°E, 2354 m, 5.VII.2019, Xue Zhang (CNU); 1♀, 1♂, CHINA, Inner Mongolia, Hohhot, Wuchuan County, Daxiyaozi, 41.046°N, 111.483°E, 1732 m, 23.VII.2019, Xue Zhang (CNU); 1♀, 2♂♂, CHINA, Inner Mongolia, Baotou City, Guyang County, Near Dadeheng, 41.130°N, 110.321°E, 1570 m, 21.VII.2019, Rongyuan Zhang (CNU); 1♂, CHINA, Inner Mongolia, Hohhot, Wuchuan County, Daqingshan Town, Sanchakou Village, 41.003°N, 111.533°E, 1661 m, 23.VII.2019, Pan Huang (CNU); 1♂, CHINA, Inner Mongolia, Hohhot, Wuchuan County, Daqingshan Town, Dongyaozi, 40.930°N, 111.393°E, 1503 m, 24.VII.2019, Xue Zhang (CNU).



Figures 40–45. (taken by Alexander V. Fateryga). *Leptochilus (Lionotulus) gobicus* (Kostylev, 1940). holotype (♂) **41**, **43–45** paratype (♀) **40**, **42**. **40**, **41** habitus in dorsal view **42**, **43** head in frontal view **44** habitus in lateral view **45** part of antenna.

Diagnosis. Female body length 5.4–6.3 mm, forewing 5.0–5.8 mm (Fig. 46); male body length 4.3–4.9 mm, forewing 4.0–4.6 mm (Fig. 47). This species resembles *L (L.) chinensis* Gusenleitner, 2001 with similar coloration (Figs 27, 28, 46, 47), antenna (Figs 36, 53), occipital carina (Figs 32, 51), pronotal carina (Figs 31, 50), hind tarsi in male (Figs 28, 47) and S2 (Figs 34, 54). Male genitalia are different from *L (L.) chinensis* Gusenleitner, 2001 (Figs 37–39, 55–57) by penis valve obvious narrow in the middle part, depression deeper than above at the top (Fig. 57). In addition, it can be distinguished from the related species and other members of the genus by the following character combination: in front view clypeus wider than long (1.1× in female, 1.2× in male), apically emargination wider than depth (2.6× in female, 1.8× in male) (Figs 48, 49), propodeum posterior surface with finely and oblique striae mixed with sparse punctures, propodeal concavity shallow, and propodeal carina present in lower part, and long about 2/3 as long as the propodeal concavity (Fig. 52).

Distribution. China (Inner Mongolia, Gansu, Qinghai).



Figures 46–57. *Leptochilus* (*Lionotulus*) *habyriganus* Kurzenko, 1977 ♀ **46, 48, 50–52, 54** ♂ **47, 49, 53, 55–57**. **46, 47** habitus in dorsal view **48, 49** head in frontal view **50** vertex and pronotum **51** gena in lateral view **52** propodeum in posterior view **53** antenna **54** metasoma in lateral view **55, 56** volsella **57** penis valve.

***Leptochilus (Lionotulus) incertus* (Kostylev, 1940)**

Figs 58–60

Odynerus incertus Kostylev, 1940: 33.*Leptochilus incertus*; van der Vecht and Fischer 1972: 47.

Material examined. *Holotype*, ♀, Bain-Houdouk, Nord Alachan, Mongolic, 20.V.1909, P. Kozlov! (Zoological Institute in St. Petersburg).

Diagnosis. Female body length 5.5 mm (Fig. 58); black, with the following parts light yellow: base half of clypeus, scape ventrally, pronotum dorsally in the front half, tegula, scutellum at posterior half, dorsal spot of mesopleuron, apical margins of femora, tibiae and tarsi, apical bands of both T1–T2 and S2 (band of T1 expand on both side and T2 with medial spots laterally). In front view, clypeus wider than long, and apically with shallow and wide emargination (Fig. 60); with large and dense punctures on apical half, with obvious white setae; frons with dense setae on lower half; frons, vertex and gena with small and sparse punctures. Punctures of mesosoma larger than those on head and metasoma (Fig. 59); pronotal carina obvious (Fig. 58). Metasoma leathery, with small and sparse punctures; the second metasomal segment with wide apical lamellae and there with a row of great punctures at base, interspaces between punctures short carina-formed (Fig. 59); S2 weakly convex in lateral view, with shallow longitudinal medial furrows at base (Fig. 59).

Male. Unknown.

Distribution. China (Inner Mongolia).

***Leptochilus (Lionotulus) kozlovi* Kurzenko, 1977**

Figs 61–71

Leptochilus kozlovi Kurzenko, 1977: 547.

Material examined. 2♀♀, 1♂, CHINA, Xinjiang, Ili Kazak Autonomous Prefecture, Huocheng County, Qingshuihe Town, Shuanggouyi village, 44.182°N, 80.685°E, 688 m, 26.VII.2019, Jie Chen (CNU); 1♂, CHINA, Xinjiang, Karamay, jinlong town, Near G217 and S201 of Ayikule Reservoir, 45.526°N, 84.916°E, 279 m, 23.VII.2019, Tingjing Li, Qian Han, Jie Chen (CNU).

Diagnosis. Female body length 4.3–5.2 mm, forewing 4.5–4.6 mm (Fig. 61); male body length 4.3–4.6 mm, forewing 4.1–4.3 mm (Fig. 62); black, with the following parts yellow: clypeus in male, scape ventrally in female, wholly scape in male, anterior half of pronotum, tegula, parategula, apical half of scutellum, apical margin of femora, tibiae (slightly dark apical margin) and most of tarsi, apical bands of both T1–T2 and S2 (broader of T1 laterally), apical margin of T3–T5 with short bands or spots (apical margin of T6 in male); A6–A13 ventrally deep yellow. Body with dense and coarse



Figures 58–60. (taken by Alexander V. Fateryga). *Leptochilus* (*Lionotulus*) *incertus* (Kostylev, 1940). holotype (♀) **58** habitus in dorsal view **59** habitus in lateral view **60** head in frontal view.

punctures, interspaces between punctures reticulate; clypeus wider than long ($1.3\times$ in female, $1.0\times$ in male), apically with shallow emargination wider than depth ($2.8\times$ in female, $2.6\times$ in male) (Figs 63, 64); clypeus in female with sparse and coarse punctures, base of emargination without punctures and smooth (Fig. 63); clypeus in male with sparse and small punctures, dense white setae (Fig. 64); frons on lower half in male with dense white setae; occipital carina slightly curved latero-ventrally (Fig. 66); A13 sharp at the apex (Fig. 71). Pronotal carina transparent and obvious (Fig. 65); metapleuron and lateral surfaces of propodeum with unbroken coarse horizontal striae mixed with coarse punctures (Fig. 67); propodeum with developed and long carina between dorsal and posterior surfaces (Fig. 68), posterior surface with coarse and oblique striae mixed with coarse punctures, propodeal carina weakly present in lower part and less than half of propodeal concavity. Punctures of metasomal segments 3–7 sparser than those on metasomal segments 1–2; the second metasomal segment with wide apical lamellae and with a row of great punctures at base, interspaces between punctures long carina-formed extending almost to the top (not reaching apical margin) (Fig. 69); S2 weakly convex in lateral view, with shallow and short longitudinal medial furrows at base (Fig. 70).

Distribution. China (Xinjiang).



Figures 61–71. *Leptochilus (Lionotulus) kozlovi* Kurzenko, 1977 ♀ **61, 63, 65–70** ♂ **62, 64, 71**. **61, 62** habitus in dorsal view **63, 64** head in frontal view **65** vertex and pronotum **66** gena in lateral view **67** mesosoma in lateral view **68** propodeum in posterior view **69, 70** metasoma in lateral view **71** part of antenna.

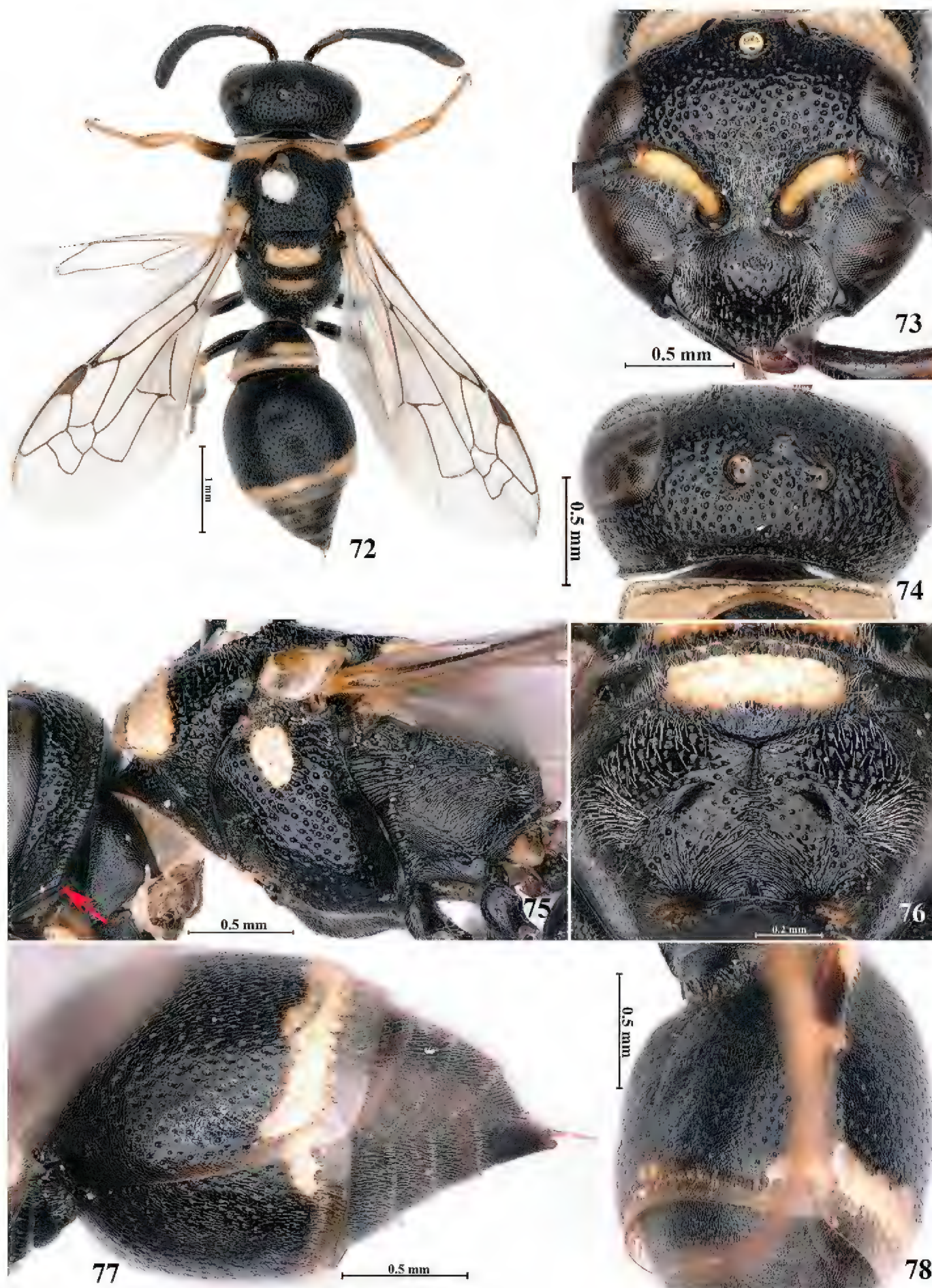
***Leptochilus (Lionotulus) locuples* Giordani Soika, 1970**

Figs 72–78

Leptochilus locuples Giordani Soika, 1970: 70; van der Vecht and Fischer 1972: 48.**Material examined.** 1 ♀, CHINA, Gansu Province, Zhangye City, Gaotai County, Heiquan Town, Yanzhibao Village, 39.607°N, 99.654°E, 1319 m, 1.VII.2019, Xue Zhang (CNU).**Diagnosis.** Female body length 5.5 mm, forewing 4.9 mm (Fig. 72); black, with the following parts whitish yellow: scape ventrally, pronotum dorsally at anterior half, tegula, parategula, scutellum at posterior half, posterior oblique plane of metanotum, dorsal spot of mesopleuron, apical margins of femora, tibiae and tarsi, apical bands of T1–T2 (band of T1 extended on lateral side) and apical small spots of S2 laterally. Body with dense and coarse punctures; in front view, clypeus wider than long (1.3×), and apically emargination wider than depth (2.9×) (Fig. 73); clypeus with large and dense punctures on apical half, with minute and dense punctures on basal half, outer margin with white setae; frons with dense setae at the lower half (Fig. 73); occipital carina developed and forming obvious angle latero-ventrally (Fig. 75). Pronotal carina developed and transparent (Fig. 74); metapleuron with horizontal striae dorsally and leathery ventrally (Fig. 75); propodeum with short and curved carina between dorsal and posterior surfaces, lateral surfaces with fine striae mixed with sparse punctures; without propodeal carina, and sparsely punctate on upper half, propodeal concavity only present in upper part, and obliterate and with oblique striae in lower half crossing posterior surface (Fig. 76). Metasoma leathery, with large and coarse punctures (Fig. 77); the second metasomal segment with wide apical lamellae and with a row of great punctures at base, interspaces between punctures short carina-formed (Fig. 77); S2 weakly convex in lateral view, with shallow longitudinal medial furrows at base, and slightly longer than half of S2 (Fig. 78).**Male.** Unknown.**Distribution.** China (new record: Gansu), Turkmenistan.***Leptochilus (Neoleptochilus) tibetanus* Giordani Soika, 1966**

Figs 79–85

Leptochilus tibetanus Giordani Soika, 1966: 99; van der Vecht and Fischer 1972: 53.**Material examined.** 7 ♀♀, CHINA, Xizang, Linzhi City, Milin County, Wolong Town, 4.VIII.2014, Tingjing Li (CNU); 1 ♀, CHINA, Xizang, Linzhi City, Bayi Town, Bujiu Township, Duodang Village, 5.VIII.2014, Tingjing Li (CNU).**Diagnosis.** Female body length 6.0–6.8 mm, forewing 5.5–6.0 mm (Fig. 79); male body length 4.5–5.5 mm; body with obvious white setae, and the setae on the head and mesosoma longer than those on the metasoma; black, with the following parts yellow: base band of clypeus in female, wholly clypeus in male, scape line in male ventrally; small spot of gena near eye, an anterior interrupted band of pronotum



Figures 72–78. *Leptochilus (Lionotulus) locuples* Giordani Soika, 1970 ♀ **72** habitus in dorsal view **73** head in frontal view **74** vertex and pronotum **75** gena and mesosoma in lateral view **76** propodeum in posterior view **77, 78** metasoma in lateral view.

dorsally, tegula, parategula, scutellum on posterior half, dorsal spots of mesopleuron, apical margin of femora, tibiae base and dorsally, tarsi, apical bands of T1–T5 (apical bands of T3–T5 incomplete), T2 laterally with circular and medial spots, apical



Figures 79–85. *Leptochilus* (*Neoleptochilus*) *tibetanus* Giordani Soika, 1966 ♀ **79** habitus in dorsal view **80** head in frontal view **81** vertex and pronotum **82** mesosoma in lateral view **83** gena in lateral view **84** propodeum in posterior view **85** metasoma in lateral view.

bands of S2–S5. Body with sparse white setae; in front view, clypeus in female slightly wider than long, and apically with semicircular emargination wider than depth (2×) (Fig. 80), emargination in male wider than in female; clypeus in female with small and sparse punctures, and interspaces between punctures with smaller punctures, with dense white setae laterally (Fig. 80), wholly with dense white setae in male; frons

and vertex with coarse and dense punctures, interspaces between punctures reticulate (Figs 80, 81); punctures on gena sparser and smaller than above, interspaces between punctures leathery, occipital carina curved latero-ventrally (Fig. 83); A13 sharp apically. Mesosoma with coarse punctures, interspaces between punctures finely punctate; punctures of pronotum and mesoscutum dense; other part of mesosoma with sparse punctures; pronotal carina narrow extremely (Fig. 81); metapleuron and lateral surfaces of propodeum with unbroken finely horizontal striae (Fig. 82); propodeum with long and dense setae, and without carina between dorsal and posterior surfaces (Fig. 84); propodeal concavity deep, propodeal carina present in lower part and less than half of propodeal concavity (Fig. 84). Metasoma with sparse and coarse punctures (Fig. 85); metasomal segments 1–3 punctures larger than those on metasomal segments 4–6; the second metasomal segment with apical lamellae and there with a row of great punctures at base, interspaces between punctures normal, not carina-formed (Fig. 85); S2 weak convex in lateral view, with shallow longitudinal medial furrows at base.

Distribution. China (Xizang).

Genus *Microdynerus* Thomson, 1874

Microdynerus Thomson, 1874: 58.

Type species. *Odynerus exilis* Herrich-Schäffer, 1839, by subsequent designation of Jones 1937.

Diagnosis. Female without cephalic foveae (Fig. 88); pronotum with anterior face usually densely punctate; mesosoma long, mesoscutum longer than wide; inner side of the trailing edge of tegula straight and not extended (except *Microdynerus robustus*); posterior face of propodeum without wide deep vertical cavity, with submarginal carina and vavula not projecting; T1 wider than long; T1–T2 with apical bands, T2 apically not carina-formed or without foveae, S2 without longitudinal furrow (Fig. 94).

Distribution. Palearctic and Nearctic Region.

Microdynerus (*Pseudomicrodynerus*) *parvulus* (Herrich-Schäffer, 1838)

Figs 86–94

Odynerus parvulus Herrich-Schäffer, 1838: 19.

Odynerus helvetius de Saussure, 1855: pl. XIII fig. 6; 1856: 295; Berland 1928: 63, figs. 104–108.

Microdynerus bifidus Morawitz, 1885: 177; Kostylev 1929: 82.

Pseudomicrodynerus helvetius; Blüthgen, 1938 (1937): 276; 1938: 446; 1952: 353; 1961: 66, 93; van der Vecht and Fischer 1972: 37.

Microdynerus parvulus; Castro, 1997: 5; Gusenleitner 2008: 38.



Figures 86–94. *Microdynerus parvulus* (Herrich-Schäffer, 1838) ♀ **86** habitus in dorsal view **87** head in frontal view **88** vertex **89** propodeum in posterior view **90** mesosoma in dorsal view **91** mesosoma in lateral view **92** metasoma in dorsal view **93** metasoma in lateral view **94** metasoma in ventral view.

Material examined. 2♀♀, CHINA, Xinjiang, Changji Hui Autonomous Prefecture, Qinghe county, Qinghe town, Ale Township, Akelangke Village, 46.690°N, 90.369°E, 1256 m, 19.VII.2019, Qian Han (CNU).

Diagnosis. Body length 5.5–5.8 mm, forewing 5.4–5.5 mm (Fig. 86); interspaces between punctures leathery; black, with the following parts whitish yellow: whole clypeus in male, antenna ventrally in male, two anterior spots of pronotum dorsally (or not), outer margin of tegula, apical bands of both T1–T2 and S2, apical spot of S3 laterally (or not), part of tibiae; mandibular teeth ferruginous in male. Body with sparse and small punctures; in front view, head slightly subquadrate, two lateral margin almost parallel (Fig. 87), in dorsal view head thick, vertex prolonged (Fig. 88); mandible enlarged and angular, the outer edge curved (Fig. 87); clypeus punctate, interspaces between big punctures densely micropunctate, and sparser at apex, clypeus wider than long (1.3× in female), apically with deep U-styled emargination wider than depth (1.5× in female) (Fig. 87); interantennal carina at the same level as frons; in female A6–A12 thick and short, A13 in male wide and flat, backward reaching apical margin of A9; frons wide and swollen, with a medial longitudinal furrow from anterior-ocellus to base of interantennal carina; frons, vertex and gena with sparse and deep punctures, interspaces with extremely minute punctures (Fig. 88); occipital carina curved latero-ventrally (Fig. 91). Mesosoma with sparse and deep punctures, interspaces with extremely minute punctures (Fig. 90); sharp angle of pronotal carina at humeral angle, and pronotal carina posteriorly with a row of short longitudinal carinae; mesoscutum with two longitudinal furrows of punctures on posterior margin; anterior margin of scutellum with a row of dense punctures, and with a shallow longitudinal furrow in the middle; metanotum medially with transverse raised bulge (Fig. 90); propodeal furrow deep, propodeal carina in the furrow developed and complete (Fig. 89). Metasoma leathery, punctures smaller and shallower than those on head and mesosoma, punctures on T1 a little larger and deeper than the second metasomal segment, and those on metasomal segments 3–6 indistinct (Figs 7–9); in dorsal view, the first metasomal segment bell-shaped, the second one with narrow apical lamellae; S2 concave basally, and flat in lateral view (Fig. 94).

Distribution. China (new record: Xinjiang), England, France, Spain, Italy, Switzerland, Germany, Austria, Belarus, Ukraine, Russia.

Key to the Chinese species of the two genera *Leptochilus* de Saussure and *Microdynerus* Thomson

- 1 Mandible enlarged and angular in outer edge, head in frontal view subquadrate (Fig. 87); mesosoma prolonged, mesoscutum longer than wide (Fig. 90); propodeum with submarginal carina and vavula not projecting (Fig. 90)
Microdynerus (Pseudomicrodynerus) parvulus (Herrich-Schäffer, 1838)
- Mandible narrow and slightly curved in outer edge, head in frontal view rounded (Figs 2–3, 11, 19, 20); mesosoma shorter, mesoscutum about as long as wide; propodeum with submarginal carina and vavula projecting (Fig. 82) 2

- 2 T1 long and bell-shaped (Fig. 79), longer than wide; the second metasomal segment with wide apical lamellae and with a row of great punctures at base, interspaces between punctures not carina-formed (Fig. 85).....
.....*Leptochilus (Neoleptochilus) tibetanus* Giordani Soika, 1966
- T1 short and semi-circular (Figs. 1, 10, 17, 18), wider than long; the second metasomal segment with wide and concave apical lamellae and with a row of great punctures at base of lamellae, interspaces between punctures carina-formed (Figs 8–9) 3
- 3 The second metasomal segment with large and coarse punctures (Figs 69, 77).....4
- The second metasomal segment with small and shallow punctures (Figs 8, 15, 25, 35, 54) 5
- 4 Occipital carina developed and forming obvious angle latero-ventrally (Fig. 75); propodeum with short and curved carina between dorsal and posterior surfaces (Fig. 76); interspaces between apical punctures of the second metasomal segment with short carina-formed (Fig. 77).....
.....*Leptochilus (Lionotulus) locuples* Giordani Soika, 1970
- Occipital carina obviously curved latero-ventrally (Fig. 66); propodeum with developed carina between dorsal and posterior surfaces (Fig. 68); interspaces between apical punctures of the second metasomal segment with carina-formed extending almost to the top (Fig. 69).....
.....*Leptochilus (Lionotulus) kozlovi* Kurzenko, 1977
- 5 Ocelli large, almost as big as diameter of antennal socket (Fig. 11); body wholly finely and sparsely punctate, smooth, and with a large area of yellow markings (Fig. 10) *Leptochilus (Lionotulus) argentifrons* (Kostylev, 1935)
- Ocelli smaller than diameter of antennal socket (Figs 19, 20); body wholly coarsely punctate, leathery, and with a smaller area of yellow markings than the above 6
- 6 Occipital carina obviously angle latero-ventrally (Figs 4, 24).....7
- Occipital carina curved latero-ventrally (Figs 32, 51, 59) 8
- 7 Pronotal carina transparent; propodeum with obvious carina between dorsal and posterior surfaces, propodeal carina half as long as propodeal concavity (Fig. 7)..... *Leptochilus (Lionotulus) angulus* sp. nov.
- Pronotal carina non-transparent; propodeum carina between dorsal and posterior surfaces longer than the above species, about 2/3 as long as the propodeal concavity (Fig. 23) *Leptochilus (Lionotulus) callidus* (Kostylev, 1940)
- 8 Clypeus apically with shallow and wide emargination; frons with dense setae on lower half (Fig. 60); male unknown
.....*Leptochilus (Lionotulus) incertus* (Kostylev, 1940)
- Apical emargination of clypeus deeper and narrower than the above; frons with sparse setae on lower half (Fig. 48); the first hind tarsus in male swollen (Figs 28, 44, 47) 9

- 9 Female clypeus with minute and dense punctures basally, and with coarser and bigger punctures apically (Figs 29, 48); in lateral view, S2 of both sexes strongly convex basally (Figs 34, 54) 10
- Female clypeus wholly with small and sparse punctures (Fig. 42); in lateral view, S2 of both sexes slightly convex basally (Fig. 44)
.....*Leptochilus (Lionotulus) gobicus* (Kostylev, 1940)
- 10 Propodeal concavity deep, propodeal carina less than half of propodeal concavity (Fig. 33); penis valve slightly narrow in the middle part, with depression at the top (Fig. 39).....*Leptochilus (Lionotulus) chinensis* Gusenleitner, 2001
- Propodeal concavity shallow, propodeal carina more than half of propodeal concavity (Fig. 52); penis valve obvious narrow in the middle part, depression deeper than the above at the top (Fig. 57)
.....*Leptochilus (Lionotulus) habyrganus* Kurzenko, 1977



Figure 95. A distribution map of all known species of these two genera *Leptochilus* and *Microdynerus* in China.

Acknowledgements

We are very grateful to Dr. Alexander V. Fateryga (Branch of the Kovalevsky Institute of Biology of the Southern Seas of RAS, Feodosiya, Russia) for helping us to take photos of type specimens deposited in the Zoological Institute in St. Petersburg. We are also grateful to Prof. James M. Carpenter (American Museum of Natural History, New York, USA), Marco Selis (Viterbo, Italy) and another anonymous reviewer

for providing their important comments on this study. And we sincerely thank Dr. Zhaohui Luo (Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi, China) for providing us with the specimens deposited in the insect collections under her care. This study was funded by Science & Technology Fundamental Resources Investigation Program (Grant No. 2022FY202100) and the National Natural Science Foundation of China (Nos: 31772490, 31372247, 31000976).

References

- Arens W (2001) The female of *Leptochilus aegineticus* Gusenleitner, 1970, hitherto incorrectly known as *Microdynerus globosus* Gusenleitner, 1997 (Hymenoptera, Eumenidae). Linzer Biologische Beiträge 33(1): 257–261.
- Berland L (1928) Faune de France 19. Hymenopteres vespiformes. II. (Eumenidae, Vespidae, Masaridae, Bethyridae, Dryinidae, Embolemidae). Faune France 19: [viii +] 208.
- Blüthgen P (1938) [1937] Systematisches Verzeichnis der Faltenwespen Mitteleuropas, Skandinaviens und Englands. Konowia, Vienna 16: 270–295.
- Blüthgen P (1938) Beiträge zur Kenntnis der paläarktischen Eumeniden (Hymenoptera, Vespidae). Deutsche Entomologische Zeitschrift 1938: 434–496. <https://doi.org/10.1002/mmnd.193819380208>
- Blüthgen P (1943) Taxonomische und biologische Notizen über paläarktische Faltenwespen (Hymenoptera, Vespidae). Stettiner Entomologische Zeitung 104: 149–158.
- Blüthgen P (1952) Eränzungen zur Faltenwespenfauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 25: 349–353.
- Blüthgen P (1953) Portuguese and Spanish wasps (Hymenoptera, Vespoidea). Memórias e Estudos do Museu Zoológico da Universidade de Coimbra 218: 1–23.
- Blüthgen P (1955) New Diploptera from Israel and the Near East. I. Bulletin of the Research Council of Israel 5B: 24–31.
- Blüthgen P (1961) Die Faltenwespen Mitteleuropas (Hymenoptera, Diploptera). Abhandlungen der Deutschen Akademie der Wissenschaften zu Berlin. Klasse für Chemie, Geologie und Biologie (2): 1–252. <https://doi.org/10.1515/9783112537084>
- Blüthgen P (1967) Faltenwespen aus Bulgarien (Hymenoptera, Diploptera). Bulletin de l'Institut de Zoologie et Muséum 23: 229–234.
- Carpenter JM (1981) [1982] The phylogenetic relationships and natural classification of the Vespoidea (Hymenoptera). Systematic Entomology 7: 11–38. <https://doi.org/10.1111/j.1365-3113.1982.tb00124.x>
- Carpenter JM (1986) A synonymic generic checklist of the Eumeninae (Hymenoptera: Vespidae). Psyche (Cambridge) 93(1–2): 61–90. <https://doi.org/10.1155/1986/12489>
- Castro L (1997) Insecta: Hymenoptera. Fam. 3a: Vespidae: Eumeninae. Catalogus de la Entomofauna Aragonesa 16: 3–8.
- de Saussure H (1852–1853) Etudes sur la famille des Vespides. 1. Monographie des guepes solitaires ou de la tribu des Eumeniens, comprenant la classification et la description de toutes

- les especes connues jusqu'a ce jour, et servant de complement au manuel de Lepeletier de Saint-Fargeau. Masson & Cherbuliez, Paris & Geneva, [lii +] 286 pp.
- de Saussure H (1854–1856) Études sur la Famille des Vespides 3. Geneva & Paris, 352 pp.
- Fateryga AV (2018) First data on the bionomics of the solitary wasp *Leptochilus membranaceus* (Morawitz) (Hymenoptera, Vespidae: Eumeninae). Entomological Review 98(3): 283–289. <https://doi.org/10.1134/S0013873818030053>
- Fateryga AV, Fateryga VV (2021) A further study of the nesting biology of *Leptochilus* (*Neoleptochilus*) *regulus* (de Saussure, 1855) (Hymenoptera, Vespidae, Eumeninae). Journal of Hymenoptera Research 84: 75–86.
- Herrich-Schäffer GAW (1838) Fauna Insectorum Germaniae initia, oder, Deutschlands Insects 154: 19. [pl 19]
- Kostylev G (1929) Materialien zur Kenntnis der Vespidenfauna Armeniens. Rev. russe Entomol, Leningrad 23: 76–82.
- Kostylev G (1935) [1934] Neue und wenig bekannte mittelasiatische Wespidenarten (Hym.). In Russian with German descriptions. Archive of the Zoological Museum of Moscow State University 1: 117–146.
- Kostylev G (1940) Espèces nouvelles et peu connues de Vespides, d'Euménides et de Masarides paléarctiques (Hymenoptera). II. Bulletin de la Société des naturalistes de Moscou, Section biologique (N.S.) 49: 24–42.
- Kurzenko NV (1977) Eumenid wasps (Hymenoptera, Eumenidae) of the Mongolian People's Republic and adjacent regions of China and southern Siberia. Insects of Mongolia 5: 537–582.
- Giordani Soika A (1938) Diagnosi di nuovi Eumenini mediterranei. Bollettino della Società Veneziana di Storia Naturale, Venice 2: 2–14.
- Giordani Soika A (1941) Diagnosi di nuovi *Leptochilus* dell'Africa minore (Hymenoptera, Vespidae). Bollettino della Società Entomologica Italiana. Florence, Genoa 78: 7–13.
- Giordani Soika A (1953) Hyménoptères récoltés par une mission Suisse au Maroc (1947). Eumeninae. Bulletin de la Société des Sciences Naturelles du Maroc, Rabat 32: 235–267.
- Giordani Soika A (1966) Eumenidi raccolti dalla spedizione Schaefer nel Tibet meridionale e Sikkim. Bollettino del Museo Civico di Storia Naturale di Venezia 17: 97–112.
- Giordani Soika A (1970) Missione Giordani Soika in Iran 1965, III. Contributo Alla Conoscenza Degli Eumenidi Del Medio Oriente. Parte I- Sistematica. Bollettino del Museo Civico di Storia Naturale di Venezia 20/21: 27–183.
- Giordani Soika A (1979) Eumenidi raccolti nell'Arabia meridionale da K. Guichard. Bollettino del Museo Civico di Storia Naturale di Venezia 30: 271–285.
- Giordani Soika A (1986) Eumenidi Palearctici nuovi o poco noti. Bollettino del Museo Civico di Storia Naturale di Venezia 35: 91–162.
- Gusenleitner J (1970) Notes on some new Eumenidae from Israel (Hymenoptera, Vespoidea). Israel Journal of Entomology 5: 55–61.
- Gusenleitner J (1973) Bemerkenswertes über Faltenwespen 5. (Diploptera, Hymenoptera). Nachrichtenblatt der Bayerischen Entomologen 22(6): 118–120.
- Gusenleitner J (1976) Bemerkenswertes über Faltenwespen 6. (Diploptera, Hymenoptera). Nachrichtenblatt der Bayerischen Entomologen 25(6): 112–119.

- Gusenleitner J (1977) Neue *Leptochilus*-Arten aus Anatolien und Nordafrika. Linzer Biologische Beiträge 9(1): 163–178.
- Gusenleitner J (1979) Die Arten der Untergattung *Neoleptochilus* Bluthgen, 1961 auf der Iberischen Halbinsel (Eumenidae, Hym.). Linzer Biologische Beiträge 11(1): 95–103.
- Gusenleitner J (1985) Neue *Leptochilus*-Arten aus dem Mittelmeergebiet und dem Iran (Hymenoptera, Eumenidae). Entomofauna 6: 81–101.
- Gusenleitner J (1993) Bestimmungstabellen mittel- und südeuropäischer Eumeniden (Vespoidea, Hymenoptera) Teil 1: Die Gattung *Leptochilus* Saussure 1852. Linzer Biologische Beiträge 25(2): 745–769.
- Gusenleitner J (1995) Bemerkungen über die gattung *Leptochilus* Saussure 1852 und Beschreibung neuer Arten dieser Gattung. (Hymenoptera, Vespoidea, Eumenidae). Linzer Biologische Beiträge 27(1): 169–181.
- Gusenleitner J (1997) Bestimmungstabellen mittel- und südeuropäischer Eumeniden (Vespoidea, Hymenoptera) Teil 7: Die Gattungen *Microdynerus* Thomson 174 und *Eumicrodynerus* Gusenleitner 1972. Linzer Biologische Beiträge 29(2): 779–797.
- Gusenleitner J (2001) A new *Leptochilus* species from China (Hymenoptera: Eumenidae). Linzer Biologische Beiträge 33(1): 239–241.
- Gusenleitner J (2002) New or notable Vespoidea from the Near East (Hymenoptera: Eumenidae, Masaridae). Linzer Biologische Beiträge 34(1): 335–343.
- Gusenleitner J (2006) Eumeninae collected in Pakistan. Linzer Biologische Beiträge 38(2): 1295–1305.
- Gusenleitner J (2008) Vespidae (Insecta: Hymenoptera). In: Schuster, R. (Hrsg.), Biosystematics and Ecology Series No. 24. Checklisten der Fauna Österreichs 3: 31–40.
- Gusenleitner J (2017) Über bemerkenswerte Faltenwespen aus der äthiopischen Region. Teil 11 (Hymenoptera, Vespidae: Eumeninae). Linzer Biologische Beiträge 49(2): 1147–1155.
- Morawitz F (1885) Eumenidarum species novae. Horae Societatis Entomologicae Rossicae. Rossicae 19: 135–181.
- Parker FD (1966) A revision of the North American species in the genus *Leptochilus* (Hymenoptera: Eumenidae). Miscellaneous publications of the Entomological Society of America 5: 153–229. <https://doi.org/10.4182/ASHC3002.5-4.153>
- Selis M (2023) Illustrated key to the genera and a checklist of Italian Vespidae (Hymenoptera). Fragmenta Entomologica 55(1): 63–88.
- Thomson CG (1874) *Vespa* Linn., Hymenoptera Scandinaviae 3: 1–94.
- van der Vecht J, Fischer FCJ (1972) Hymenopterorum Catalogus. Pars 8. Palaearctic Eumenidae. Hymenopterorum Catalogus 8: 1–199.